

CLAIMS

WHAT IS CLAIMED IS:

- 1 1. An optical amplifier comprising:
 - 2 a device substrate;
 - 3 a first waveguide embedded in the device substrate; and
 - 4 a first plurality of lasers positioned to provide a first plurality of light beams
 - 5 substantially transverse to the first waveguide.
- 1 2. The optical amplifier of claim 1 wherein each of the first plurality of lasers are
2 spaced apart from one another along a length of the first waveguide.
- 1 3. The optical amplifier of claim 2 wherein the first plurality of lasers are vertical
2 cavity surface emitting lasers.
- 1 4. The optical amplifier of claim 3 wherein the first plurality of lasers share a
2 common substrate.
- 1 5. The optical amplifier of claim 4 wherein the vertical cavity surface emitting
2 lasers are bonded to the device substrate.
- 1 6. The optical amplifier of claim 1 wherein the device substrate is a phosphate
2 glass doped with Erbium.

1 7. The optical amplifier of claim 1 further comprising:
2 a second waveguide embedded in the device substrate; and
3 a second plurality of lasers positioned to provide a second plurality of light
4 beams substantially transverse to the second waveguide.

1 8. The optical amplifier of claim 1, wherein the first plurality of lasers are evenly
2 spaced apart from one another.

1 9. A method of amplifying an optical signal comprising:
2 directing the optical signal through a waveguide, the optical signal having a
3 first direction of propagation; and
4 applying a plurality of light beams substantially transverse to the first
5 direction of propagation.

1 10. The method of claim 9, wherein the plurality of light beams is provided by a
2 plurality of laser diodes.

1 11. The method of claim 10, wherein the optical signal has a wavelength of
2 approximately 1550 nm, and the plurality of light beams has a wavelength of
3 approximately 980 nm.

1 12. The method of claim 11, wherein the applying the plurality of light beams
2 further comprises:

3 using a plurality of lasers each using less than 50 mW of power.

1 13. The method of claim 11, wherein the applying the plurality of light beams
2 further comprises:

3 using a plurality of lasers each using less than 20 mW of power.

14. The method of claim 9 further comprising:

reflecting the plurality of light beams back at the waveguide after passing
through the waveguide.

1 15. A method of making an optical signal amplifier comprising:

2 attaching a plurality of light sources to a surface of a substrate, the substrate
3 having a waveguide embedded within, wherein the plurality of light
4 sources are directed substantially transverse to the waveguide.

1 16. The method of claim 15, wherein the attaching of the plurality of light sources
2 comprises:

3 bonding a plurality of vertical cavity surface emitting lasers to the surface of
4 the substrate.

1 17. The method of claim 16, wherein each of the plurality of vertical cavity
2 surface emitting lasers is spaced apart in a line on a common semiconductor substrate.

1 18. The method of claim 16, wherein each of the plurality of vertical cavity
2 surface emitting lasers is spaced apart by a constant distance.

1 19. The method of claim 16, wherein the plurality of vertical cavity surface
2 emitting lasers each operate at less than 50 mW.

1 20. The method of claim 16, wherein the plurality of vertical cavity surface
2 emitting lasers each operate at less than 20 mW.

1 21. An optical amplifier comprising:
2 a substrate;
3 a waveguide embedded within the substrate, the waveguide having a primary
4 direction of propagation;
5 an array of lasers positioned to provide a plurality of pumped light beams
6 transverse to the primary direction of propagation.

1 22. The optical amplifier of claim 21, wherein at least one of the array of lasers
2 operates at less than 20 mW of power.